

north of Montana by the morning of the 26th, showing a steep pressure gradient from New Mexico northward to the storm center. A northwesterly gale resulted at Pueblo, from 9 a. m. to 3 p. m., reaching a maximum movement of 52 miles per hour from the northwest at 11:42 a. m., breaking all but two local maximum wind records for the month. The resulting high temperature shows an unmistakable chinook condition.

*December 27.*—The storm center had advanced to Lake Superior by the morning of the 27th, but the pronounced tendency to form secondary depressions over the eastern slope is again verified. This slight depression prolonged the local chinook condition during the morning and forenoon of the 27th, and was attended by a brisk westerly wind during the early hours of the day, the maximum being 34 miles per hour from the west at 1:14 a. m. The eastern slope chinook was, no doubt, augmented by the general precipitation prevailing on the western slope in Colorado on the date mentioned above.

*December 28.*—An area of high pressure had moved southward from the Canadian interior over the eastern slope and the central valleys by the morning of the 28th, thus again disturbing the persistent foehn conditions, but another storm had appeared over British Columbia, and a disturbance was central over southern Utah.

*December 29.*—The storms had crossed the Divide by the morning of the 29th, being replaced by a high pressure area, thus reestablishing temporary chinook conditions. A brisk westerly wind prevailed between 1 and 2 a. m. reaching a maximum of 26 miles per hour; the local temperature responded by rising from 22° at midnight to 40° at 2 a. m. The foehn conditions gradually gave way during the afternoon, thus ending one of the most persistent periods of warm westerly winds in the history of this station.

#### CLIMATE OF KANSAS.<sup>1</sup>

By T. B. JENNINGS, Section Director. Dated Topeka, Kans., December 7, 1907.

Kansas, the central State of the Union, is situated between 37° and 40° north latitude, and 94° 38' and 102° 2' west longitude.

The State ranges in elevation from 700 feet above sea level in the southeastern part of Montgomery County to 4,120 feet in the northwestern part of Greeley and southwestern part of Wallace counties. For climatic purposes the State is technically divided into western, middle, and eastern divisions. The first named comprises the four western tiers of counties in the northern half and the five western tiers of counties in the southern half of the State. Marshall, Riley, Geary, Morris, Chase, Greenwood, Elk, and Chautauqua counties constitute the western counties of the eastern division.

The average and extreme values of each element for all the stations in each of the three divisions of the State are given in the accompanying Tables 1 and 2.

For comparing temperature conditions it is essential that we have a standard of value, and this standard is assumed to be the average temperature, be it daily, monthly, or annual, and this average when determined from a long period of years is denominated the normal. But in studying the climate of a place the average temperature will be misleading if sole reliance is placed upon it. The extremes of temperatures are also controlling factors; for instance, on the average for the whole State the temperature for January is 29.2°, but during the past twenty years our temperature in January has ranged between 34° below zero in the eastern division and 80° above zero in the western, a range of 114° for the whole State during twenty years.

The mean annual temperature varies between 51° in the extreme northwestern counties and 57° in the extreme southeastern.

The mean winter temperature ranges from 28° in the northern counties to 33° and 34° in the southern. The mean spring temperature varies between 50° in the northwestern counties and 57° in the southeastern. The mean summer temperature ranges from 74° in the northwestern counties to 79° in the southeastern. The mean autumn temperature varies between 52° in the northwestern counties and 58° in the southeastern.

#### MAXIMUM TEMPERATURE.

Over a large part of the State the highest temperatures recorded exceed 110°, tho it has not reached that point at Wichita, Hutchinson, or Dodge City. Nor has it reached that height in the eastern counties north of Cherokee, nor in the northern counties.

The recorded maximum temperature reached 115° in 1860, 1894, and 1896.

#### MINIMUM TEMPERATURE.

In five of the past twenty years the minimum temperature for December has not gone below zero. Since records have been kept the minimum temperature has fallen below zero every January, and has reached 30° below zero, or lower, in January, 1887, 1888, 1892, and 1905.

During the past twenty years the minimum temperature in February has been zero, or lower, except in February, 1906, when the lowest temperature recorded in the State was 1° above zero. The minimum temperature in February reached 30° below zero, or lower, in 1899 and 1905.

There had been some low temperatures previously. In 1780 the Kaw River remained frozen from one full moon to the next. During the winter of 1796-97 "all streams remained frozen for 30 suns." These traditions are borne out by conditions that prevailed in our neighborhood. In the cold of 1780 Bayou St. John (New Orleans) was frozen over. In 1796-97 the Ohio and Mississippi rivers were frozen over below Cairo, Ill.; the minimum temperature at Cincinnati being 14° below zero in December and 18° below in January. January and February, 1831, were "bitter cold," and in December, 1831, "all streams were frozen," and at the same time the Mississippi was frozen over for a distance of 130 miles below the mouth of the Ohio River. February, 1838, was always referred to by the Indians as a "cold moon." The mean temperature at Fort Gibson, Ind. T., was 15° below the normal for that month. The winter of 1855-56 was one of the severest ever known in this latitude. The mean temperature for January, 1856, at Fort Leavenworth, was 10.1° and at Fort Riley it was 11.0°. January, 1857, was also cold, the mean temperature at Fort Leavenworth being 12.1° and at Fort Riley 9.4°. January, 1862, 1868, 1873, 1875, and 1886 were exceptionally cold, as shown by records at Forts Leavenworth and Riley.

#### FROST.

The average date of the last killing frost in spring ranges from April 6 in the extreme southeast corner of the State to May 5 in the northwestern counties. The average date of the first killing frost in autumn ranges from September 30 in the northwestern counties to October 25 in the extreme southeastern. The average number of growing days (interval between last and first killing frosts) ranges from 150 in the northwestern counties to 200 in the southeastern. Killing frosts in May have occurred at all stations except Wichita and Columbus, the latest recorded occurring May 26, 1901. The dates of earliest killing frosts recorded in the fall range from September 7 in the northwestern counties to October 9 in the extreme southeastern.

#### WINDS.

The prevailing direction of wind is from the north during December and from the northwest during the rest of the winter. It is from the southwest to north during March and from the south during the rest of the year.

<sup>1</sup> See Monthly Weather Review, December, 1906, p. 579.

TABLE 1.—Climatological data for Kansas.

Month and year.	Temperature (in ° F.).												Precipitation (in inches).												
	Average.				Maximum.				Minimum.				Average.				Greatest.				Least.				
	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	
<b>January.</b>																									
1887.....	24.6	26.7	26.7	26.0	70	74	73	—32	—20	—21	0.39	0.21	0.17	0.26	0.82	0.55	0.33	0.00	0.00	0.00	0.00	0.00	0.00	T.	
1888.....	21.7	20.7	20.8	20.9	70	70	73	—31	—32	—28	0.76	0.41	0.16	0.56	1.60	1.30	0.35	0.20	0.00	0.00	0.00	0.00	0.00	T.	
1889.....	29.8	29.4	26.3	27.6	60	60	63	—6	—8	—9	1.29	1.16	1.13	1.19	2.15	1.75	1.82	T.	0.27	0.30	0.30	0.30	0.30	0.30	T.
1890.....	28.7	26.2	28.1	27.3	75	77	79	—22	—22	—21	2.37	1.58	0.93	1.49	3.17	2.55	1.30	1.27	0.13	0.10	0.20	0.50	0.50	0.30	T.
1891.....	32.2	30.8	28.2	30.4	62	62	71	—2	—2	—3	1.74	1.65	1.15	1.51	2.96	4.35	2.00	0.82	0.50	0.30	0.30	0.30	0.30	T.	
1892.....	25.5	26.5	27.1	26.4	73	75	77	—34	—24	—24	1.38	0.88	0.24	0.65	3.05	0.65	0.73	0.15	0.02	0.02	0.02	0.02	0.02	T.	
1893.....	24.6	30.2	32.7	29.3	68	76	75	—9	—6	—11	0.18	0.08	0.07	0.11	0.73	0.26	0.50	T.	T.	T.	T.	T.	T.	T.	
1894.....	30.1	28.6	26.5	28.5	75	75	77	—17	—22	—26	1.64	0.40	0.21	0.75	3.48	1.87	0.98	0.06	0.00	0.00	0.00	0.00	0.00	T.	
1895.....	25.3	25.7	25.0	29.3	76	76	72	—14	—12	—17	0.72	0.53	0.45	0.57	1.61	2.01	1.00	0.16	0.06	0.06	0.06	0.06	0.06	T.	
1896.....	33.0	34.0	35.1	34.2	68	75	77	—7	—6	—18	0.53	0.72	0.87	0.71	1.28	1.45	1.05	0.26	0.26	0.16	0.16	0.16	0.16	T.	
1897.....	28.5	28.7	28.1	28.4	68	65	63	—8	—12	—16	1.89	0.98	0.43	1.10	5.46	2.50	1.50	0.45	0.21	T.	T.	T.	T.	T.	
1898.....	33.7	32.0	30.1	31.9	75	70	71	—1	—3	—1	3.08	1.47	0.61	1.72	4.97	2.31	2.00	0.83	0.57	0.04	0.04	0.04	0.04	T.	
1899.....	30.4	30.0	29.6	30.1	66	66	66	—12	—18	—18	0.43	0.28	0.30	0.35	1.20	0.80	0.90	0.02	0.00	T.	T.	T.	T.	T.	
1900.....	35.0	35.3	35.3	35.3	70	71	75	—13	—5	—8	0.29	0.22	0.08	0.22	1.06	0.60	0.40	0.00	0.00	0.00	0.00	0.00	0.00	T.	
1901.....	34.0	32.0	31.0	32.6	64	71	80	—11	—12	—21	0.60	0.34	0.24	0.42	1.70	0.75	0.58	0.11	0.02	0.03	0.03	0.03	0.03	T.	
1902.....	30.5	29.9	30.2	30.2	74	72	75	—22	—17	—17	0.95	1.01	0.47	0.86	1.63	2.31	1.20	0.31	0.32	0.15	0.15	0.15	0.15	T.	
1903.....	32.0	31.9	33.9	32.2	65	72	76	—8	—4	—7	0.49	0.25	0.14	0.33	1.15	0.60	0.43	T.	T.	T.	T.	T.	T.	T.	
1904.....	29.2	29.4	29.2	29.1	68	72	70	—14	—19	—10	1.03	0.22	0.05	0.51	2.13	1.13	0.16	0.35	T.	T.	T.	T.	T.	T.	T.
1905.....	21.6	21.1	23.5	21.8	67	67	67	—21	—30	—26	0.98	0.86	0.74	0.88	2.45	1.50	1.40	0.46	0.42	0.27	0.27	0.27	0.27	T.	
1906.....	35.0	34.9	36.1	35.2	72	73	77	—6	—2	—5	1.16	0.49	0.34	0.71	1.43	0.75	0.45	0.22	0.14	T.	T.	T.	T.	T.	
<b>Averages and extremes for 20 years.</b>																									
<b>February.</b>																									
1887.....	32.4	29.6	27.0	30.0	79	74	75	—12	—10	—16	1.28	0.61	0.55	0.84	2.05	1.13	1.32	0.20	0.14	0.05	0.05	0.05	0.05	T.	
1888.....	34.4	37.9	38.0	36.6	72	78	78	—7	0	0	1.33	0.53	1.00	1.05	2.23	1.90	1.69	0.50	0.00	T.	T.	T.	T.	T.	
1889.....	27.2	29.1	25.8	27.4	76	78	67	—16	—12	—17	1.34	0.45	0.41	0.73	3.05	1.20	0.85	0.21	0.02	0.04	0.04	0.04	0.04	T.	
1890.....	33.5	32.7	32.6	32.9	77	79	85	—10	—10	—14	0.57	0.36	0.86	0.42	1.03	0.85	3.30	0.20	0.08	0.12	0.12	0.12	0.12	T.	
1891.....	30.5	29.6	28.2	29.8	78	76	80	—10	—6	—4	1.71	0.94	0.22	0.20	2.72	2.06	1.75	0.50	T.	T.	T.	T.	T.	T.	T.
1892.....	37.1	35.3	36.8	35.3	78	72	75	—1	—1	—2	4.25	2.94	1.11	2.77	6.31	2.75	2.41	0.75	0.78	0.40	0.40	0.40	0.40	T.	
1893.....	28.4	30.0	29.3	29.2	67	80	78	—10	—15	—18	0.96	0.51	0.24	0.58	1.69	1.24	1.60	0.20	0.00	T.	T.	T.	T.	T.	T.
1894.....	27.9	26.6	21.5	25.3	67	79	64	—11	—12	—16	1.54	1.92	1.14	1.20	2.82	2.25	2.51	0.54	0.10	0.30	0.30	0.30	0.30	T.	
1895.....	25.3	25.9	23.7	24.8	73	75	73	—20	—24	—25	0.74	1.75	1.16	2.22	6.00	3.15	2.36	0.17	0.30	0.30	0.30	0.30	0.30	T.	
1896.....	37.6	38.1	37.9	37.9	86	84	84	—1	—2	5	0.56	0.21	0.03	0.27	1.03	0.70	0.20	T.	T.	T.	T.	T.	T.	T.	
1897.....	33.9	33.6	33.3	33.5	75	77	73	—3	—3	—6	1.50	1.35	0.95	1.16	3.45	1.70	2.38	0.79	0.45	0.15	0.15	0.15	0.15	T.	
1898.....	36.5	37.0	37.0	36.9	75	75	77	—7	—1	—2	1.80	1.24	0.14	0.66	2.46	3.04	0.60	0.52	0.00	0.00	0.00	0.00	0.00	T.	
1899.....	19.7	19.4	18.6	19.6	72	73	71	—34	—53	—32	1.12	0.37	0.37	0.69	2.09	1.27	1.18	0.50	0.00	T.	T.	T.	T.	T.	T.
1900.....	26.4	28.5	26.6	27.9	70	66	70	—13	—10	—11	2.59	1.46	0.93	1.78	3.79	2.74	1.60	1.17	0.32	0.25	0.25	0.25	0.25	T.	
1901.....	28.6	27.5	27.4	28.0	67	72	78	—13	—15	—16	1.54	1.33	0.69	1.24	2.53	2.55	1.36	1.10	0.59	0.22	0.22	0.22	0.22	T.	
1902.....	24.3	26.4	31.8	26.9	66	72	74	—12	—17	—15	1.17	0.57	0.43	0.78	3.50	1.42	1.42	1.10	0.12	0.12	0.12	0.12	0.12	T.	
1903.....	28.9	27.2	24.0	27.4	68	74	71	—22	—22	—21	2.05	1.79	2.67	2.09	4.20	4.20	4.45	0.99	0.52	1.79	1.79	1.79	1.79	T.	
1904.....	32.2	32.3	33.7	32.6	85	91	87	—1	—5	—7	0.27	0.06	0.04	0.11	1.50	0.27	0.27	0.16	0.02	T.	T.	T.	T.	T.	T.
1905.....	20.9	21.2	21.1	21.2	72	74	86	—35	—40	—4	1.24	0.76	0.57	0.98	2.42	1.40	1.23	0.59	0.27	0.10	0.10	0.10	0.10	T.	
1906.....	35.6	36.0	35.6	35.8	75	77	81	—4	—4	—4	1.24	0.46	0.42	0.77	0.90	1.00	0.60	0.50	0.20	0.02	0.02	0.02	0.02	T.	
<b>Averages and extremes for 20 years.</b>																									
<b>March.</b>																									
1887.....	45.2	46.4	44.8	45.8	84	88	86	10	18	10	1.19	0.05	0.04	0.60	2.75	0.20	0.17	0.03	0.00	0.00	0.00	0.00	0.00	T.	
1888.....	39.2	35.6	35.1	37.2	87	84	78	0	0	—10	2.71	1.64	1.17	2.00	6.25	3.37	4.92	2.00	0.70	0.30	0.30	0.30	0.30	T.	
1889.....	43.3	42.2	40.6	43.0	80	80	81	14	1																

TABLE 1.—Climatological data for Kansas—Continued.

Month and year.	Temperature (in ° F.).												Precipitation (in inches).												
	Average.				Maximum.				Minimum.				Average.				Maximum.				Minimum.				
	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	
	May.	June.	July.	August.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	
1867.	69.5	71.2	67.6	60.5	98	98	95	35	2.81	2.85	2.64	2.56	6.42	2.91	2.69	1.12	1.04	1.04	1.48	1.04	1.04	1.04	T.		
1888.	62.6	63.1	59.3	61.7	91	94	105	30	3.50	3.20	3.03	3.24	6.63	5.00	6.94	2.02	1.65	1.65	1.22	1.65	1.65	1.65	T.		
1889.	62.7	64.1	61.7	62.9	94	100	100	30	2.95	2.99	2.13	5.48	12.14	11.60	7.00	4.50	3.46	3.46	2.70	1.50	3.46	3.46	2.70	1.50	
1890.	63.9	64.5	64.9	64.4	98	97	106	30	2.63	1.83	0.99	2.08	6.84	5.18	2.96	1.24	1.24	1.24	T.	1.24	1.24	1.24	T.		
1891.	62.1	62.0	62.3	62.1	92	95	96	30	2.97	4.97	5.39	3.99	4.78	7.31	2.57	1.72	1.72	1.72	1.72	1.72	1.72	1.72	T.		
1892.	60.3	59.4	55.7	58.5	94	96	96	35	2.8	2.7	2.44	1.45	3.04	7.62	5.64	3.45	3.05	3.05	3.05	0.92	0.92	0.92	0.92	T.	
1893.	62.1	62.4	60.0	61.5	92	99	108	31	2.3	17	5.22	4.44	1.45	3.04	8.40	5.15	2.96	2.54	2.54	2.54	2.70	2.70	2.70	2.70	
1894.	65.6	64.9	65.2	65.2	98	100	102	30	2.2	2.72	2.72	2.72	4.00	4.00	4.00	6.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	T.	
1895.	66.7	66.9	63.3	65.8	103	108	108	27	2.8	3.35	1.46	2.89	2.57	6.66	4.00	6.10	1.10	1.10	1.10	0.98	0.98	0.98	0.98	T.	
1896.	70.1	70.2	66.4	66.8	97	107	106	40	3.1	7.53	4.14	1.81	4.75	12.67	12.01	4.47	1.75	1.75	1.75	1.27	1.27	1.27	1.27	T.	
1897.	64.5	63.8	63.6	64.1	98	96	96	38	3.0	2.26	3.35	1.02	2.04	4.84	6.92	3.77	0.60	0.60	0.60	0.01	0.01	0.01	0.01	T.	
1898.	64.6	63.7	60.3	62.9	93	95	95	33	3.1	2.9	5.86	5.70	6.28	11.88	11.20	10.31	3.46	3.46	3.46	2.62	2.62	2.62	2.62	T.	
1899.	67.6	68.0	66.0	67.4	93	104	105	32	2.9	4.25	4.22	1.69	3.68	7.37	8.43	8.80	0.26	0.26	0.26	0.40	0.40	0.40	0.40	T.	
1900.	65.5	65.4	63.6	65.5	94	94	95	38	3.2	2.9	4.31	8.81	1.41	3.89	6.67	6.50	3.87	2.58	2.58	2.58	1.08	1.08	1.08	1.08	T.
1901.	63.9	63.1	61.8	63.1	91	95	95	30	3.0	2.5	1.78	1.75	1.87	1.64	4.12	3.11	2.45	0.44	0.44	0.44	0.18	0.18	0.18	0.18	T.
1902.	69.5	68.5	66.4	68.4	95	101	100	39	3.7	35	7.78	6.92	4.60	6.64	11.40	10.88	10.00	4.08	4.08	4.08	3.39	3.39	3.39	3.39	T.
1903.	68.3	62.1	60.0	62.4	89	91	92	20	2.3	29	10.23	9.71	3.84	8.57	16.34	17.34	7.45	6.96	6.96	6.96	5.53	5.53	5.53	5.53	T.
1904.	62.9	62.3	61.8	62.4	92	94	94	38	2.1	28	7.21	5.74	3.35	8.51	11.71	8.28	4.59	3.28	3.28	3.28	2.28	2.28	2.28	2.28	T.
1905.	64.7	63.8	60.1	63.1	92	95	92	33	3.2	29	5.68	4.01	3.57	4.54	8.98	8.98	8.11	3.80	3.80	3.80	2.10	2.10	2.10	2.10	T.
1906.	66.4	64.6	63.4	65.0	99	97	97	27	2.5	30	3.28	2.56	1.69	7.32	7.32	2.66	2.66	2.66	2.66	0.70	0.70	0.70	0.70	T.	
Averages and extremes for 20 years.....																									
65.0	64.7	62.7	64.3	103	107	106	20	20	17	5.19	4.10	2.78	4.14	16.34	17.84	10.31	0.41	0.41	0.41	0.18	0.18	0.18	0.18	T.	
June.....																									
76.2	76.8	76.3	76.2	102	104	102	45	44	52	4.69	3.50	2.47	3.58	9.63	7.60	4.12	2.12	2.12	2.12	0.80	0.80	0.80	0.80	T.	
75.1	75.2	73.6	74.6	103	102	105	42	38	44	5.44	3.04	2.04	3.96	9.14	5.63	5.16	3.91	3.91	3.91	1.53	1.53	1.53	1.53	T.	
71.0	72.3	70.0	71.2	99	98	105	41	42	40	4.69	3.90	3.35	4.01	8.85	7.89	10.03	1.15	1.15	1.15	0.49	0.49	0.49	0.49	T.	
77.2	77.8	77.7	77.6	106	107	106	39	42	33	2.69	3.66	1.76	2.65	4.73	9.02	4.71	1.26	1.26	1.26	0.48	0.48	0.48	0.48	T.	
72.0	70.8	69.4	70.7	96	100	100	46	46	37	8.67	4.92	5.24	6.28	14.70	7.40	10.84	4.25	2.93	2.93	2.32	2.32	2.32	2.32	T.	
74.7	74.0	71.4	73.4	104	104	109	43	38	33	2.18	1.86	1.58	1.87	4.57	4.67	3.34	0.26	0.26	0.26	0.23	0.23	0.23	0.23	T.	
78.6	75.2	75.3	75.3	102	112	114	46	42	35	5.48	4.26	2.00	9.11	13.10	9.80	4.04	2.21	2.21	2.21	0.87	0.87	0.87	0.87	T.	
74.9	74.6	73.2	74.2	105	108	110	41	31	34	5.85	6.31	2.67	4.94	11.00	14.98	4.93	1.90	1.90	1.90	1.31	1.31	1.31	1.31	T.	
74.2	73.2	69.7	71.7	105	108	105	44	44	34	5.04	5.10	3.47	5.01	8.85	7.00	9.00	2.41	2.41	2.41	2.73	2.73	2.73	2.73	T.	
73.6	74.6	74.1	74.1	105	110	114	41	41	39	3.44	5.71	3.51	4.32	7.84	9.97	6.41	1.97	1.97	1.97	0.86	0.86	0.86	0.86	T.	
75.5	76.2	73.2	73.7	105	111	113	39	38	38	5.45	4.16	2.90	5.64	11.01	6.82	5.00	2.98	2.98	2.98	0.27	0.27	0.27	0.27	T.	
76.0	75.5	73.8	75.0	101	104	108	52	49	40	5.09	4.46	3.64	6.60	9.96	8.07	3.86	2.65	2.65	2.65	1.65	1.65	1.65	1.65	T.	
74.2	73.5	73.9	73.9	97	110	110	43	44	40	5.15	4.21	3.21	3.76	5.53	8.30	11.17	1.50	4.03	4.03	0.58	0.58	0.58	0.58	T.	
74.7	75.4	74.7	74.9	107	108	110	46	46	43	4.85	2.78	3.14	3.68	10.30	7.20	7.55	0.98	0.55	0.55	1.26	1.26	1.26	1.26	T.	
77.7	77.6	76.1	77.3	107	108	107	40	41	37	2.40	2.83	1.00	2.35	4.82	6.50	2.63	0.36	0.36	0.36	0.30	0.30	0.30	0.30	T.	
71.0	71.2	70.5	70.9	100	104	106	36	34	34	7.37	6.52	3.51	6.64	12.45	11.66	6.53	3.49	3.49	3.49	0.48	0.48	0.48	0.48	T.	
70.1	70.2	71.2	70.4	98	100	99	47	42	35	8.80	6.75	4.17	7.94	16.07	13.22	7.11	3.47	3.47	3.47	2.02	2.02	2.02	2.02	T.	
75.1	76.0	78.0	78.0	108	108	105	48	48	44	4.44	2.74	2.74	4.10	12.41	10.41	5.59	0.99	0.99	0.99	0.45	0.45	0.45	0.45	T.	
80.1	81.2	79.4	80.2	106	109	111	49	50	45	3.36	2.63	3.39	3.13	7.03	7.13	4.77	0.70	0.70	0.70	0.05	0.05	0.05	0.05	T.	
77.2	78.4	77.5	77.7	108	110	110	50	48	46	3.31	2.72	2.98	3.00	6.80	5.30	6.07	0.80	0.98	0.98	0.82	0.82	0.82	0.82	T.	
76.3	76.7	75.2	76.2	98	102	106	45	51	49	6.86	3.74	3.29	6.47	11.44	5.32	4.95	0.72	0.72	0.72	0.65	0.65	0.65	0.65	T.	
77.3	78.8	77.3	77.9	102	104	106	52	48	43	4.69	2.46	2.46	3.46	7.86	11.59	4.95	2.55	2.55	2.55	1.08	1.08	1.08	1.08	T.	
85.9	86.9	82.6	85.0	111	112	109	52	50	44	2.49	1.49	1.55	1.89	4.82	3.95	2.95									

TABLE 1.—*Climatological data for Kansas—Continued.*

Month and year.	Temperature (in ° F.).												Precipitation (in inches).													
	Mean.				Maximum.				Minimum.				Average.				Greatest.				Least.					
	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	State.	Eastern division.	Middle division.	Western division.	Eastern division.	Middle division.	Western division.	Eastern division.	Middle division.	Western division.	
<b>September.</b>																										
1887.....	68.7	70.6	68.2	68.7	99	102	101	99	32	3.89	3.42	1.64	2.76	5.73	5.22	4.20	1.65	0.80	0.14	63.1	64.0	65.0	66.0	67.0		
1888.....	65.9	70.1	66.6	67.9	100	98	98	98	32	1.14	0.72	0.36	0.72	3.91	2.78	1.50	0.23	0.00	0.00	64.0	65.0	66.0	67.0	68.0		
1889.....	64.0	66.2	67.5	65.9	101	97	100	90	28	3.70	1.46	0.53	1.90	10.59	5.85	1.71	0.88	0.00	0.00	64.3	65.8	66.1	67.4	68.7		
1890.....	64.3	65.8	66.1	66.4	98	104	104	98	27	3.53	1.55	0.90	1.84	6.62	3.28	2.20	0.88	0.20	0.20	71.6	69.9	70.2	70.6	70.9		
1891.....	71.6	69.9	70.2	70.6	107	105	102	91	34	0.99	2.71	3.77	2.49	2.30	9.00	8.60	0.15	0.72	1.40	69.7	71.2	68.5	69.8	70.7		
1892.....	69.7	71.2	68.5	69.8	97	99	103	96	32	1.60	1.19	0.41	1.03	4.05	3.99	1.60	0.36	0.28	T.	71.5	71.5	67.6	70.5	110		
1893.....	71.5	71.5	67.6	70.5	110	109	105	94	32	3.51	2.30	1.69	2.50	5.99	3.73	2.93	0.77	1.32	0.78	69.4	69.4	68.7	68.5	70.4		
1894.....	69.4	69.4	68.7	68.5	100	104	107	92	26	5.44	3.80	1.62	8.62	9.44	9.72	3.84	2.70	0.86	0.25	73.8	73.9	70.9	72.7	105		
1895.....	73.8	73.9	70.9	72.7	105	110	107	97	20	2.85	0.72	0.60	1.71	10.12	2.18	2.58	0.73	T.	0.00	66.1	66.7	64.8	65.8	101		
1896.....	66.1	66.7	64.8	65.8	101	108	106	92	29	2.91	3.40	1.67	2.99	6.88	6.44	4.15	1.90	1.12	0.77	75.2	74.3	72.6	74.0	105		
1897.....	75.2	74.3	72.6	74.0	105	104	103	96	40	1.25	1.35	1.48	1.35	2.75	2.80	3.42	0.65	0.45	0.08	71.3	70.5	66.8	69.4	102		
1898.....	71.3	70.5	66.8	69.4	102	106	108	98	30	2.08	3.00	2.94	3.61	3.85	9.39	5.40	6.58	1.96	0.91	1.10	68.1	69.3	68.9	68.8	103	
1899.....	68.1	69.3	68.9	68.8	103	108	107	95	25	1.75	2.55	1.32	1.91	4.10	4.76	3.02	0.55	0.00	0.25	71.2	70.7	68.0	70.4	108		
1900.....	71.2	70.7	68.0	70.4	108	104	101	99	35	2.08	5.91	3.23	6.35	8.78	7.15	3.98	2.98	0.78	0.78	69.2	69.8	67.5	69.1	100		
1901.....	69.2	69.8	67.5	69.1	100	99	98	90	30	2.94	2.75	2.97	3.12	6.02	5.07	9.74	1.17	0.50	0.22	63.1	64.0	64.6	63.8	89		
1902.....	63.1	64.0	64.6	63.8	89	95	102	29	29	24	4.64	3.43	2.26	3.62	6.56	7.02	8.57	2.93	1.55	0.25	66.9	67.8	66.1	66.8	100	
1903.....	66.9	67.8	66.1	66.8	98	100	101	32	29	21	3.61	1.86	0.49	2.35	7.69	5.28	0.83	1.12	0.05	0.08	70.9	70.2	68.9	70.2	101	
1904.....	70.9	70.2	68.9	70.2	101	103	103	34	30	25	2.95	2.38	2.37	2.60	5.01	5.14	5.39	0.64	0.73	1.26	71.2	70.7	71.4	70.7	107	
1905.....	71.2	71.9	70.7	71.4	107	105	100	37	39	35	7.92	3.94	1.90	5.06	11.76	8.18	5.11	4.00	1.19	0.38	72.2	69.9	67.8	70.4	100	
1906.....	72.2	69.9	67.8	70.4	100	99	98	86	31	28	3.75	4.71	2.65	8.81	8.18	10.20	9.26	1.26	1.90	0.50	Averages and extremes for 20 years.....	69.2	69.7	67.9	69.0	110
<b>October.</b>																										
1887.....	54.2	56.0	53.5	54.6	92	96	94	20	17	10	2.88	1.14	1.02	1.40	4.81	2.05	3.00	0.63	0.50	0.35	59.8	54.0	52.6	55.1	95	
1888.....	59.8	54.0	52.6	56.6	91	89	87	18	22	21	2.47	0.68	1.47	1.53	4.25	3.14	2.20	1.96	0.12	0.81	54.6	56.0	55.7	55.4	96	
1889.....	54.6	56.0	55.7	55.4	96	98	98	26	24	20	1.84	2.88	2.39	2.37	2.75	5.77	4.46	0.94	0.00	0.05	55.7	55.4	54.0	55.0	91	
1890.....	55.7	55.4	54.0	55.0	91	89	88	19	22	21	3.54	1.09	0.68	1.77	6.98	3.85	2.29	0.50	0.00	0.05	56.3	54.9	53.1	54.8	99	
1891.....	56.3	54.9	53.1	54.8	99	98	98	22	24	21	2.18	3.79	1.32	1.89	3.01	7.60	4.50	0.30	0.78	T.	57.9	58.2	56.0	54.9	93	
1892.....	57.9	58.2	56.0	54.9	93	97	99	20	21	21	3.19	2.05	0.61	1.94	6.94	4.34	2.55	0.90	0.20	T.	57.7	56.4	52.9	55.1	95	
1893.....	57.7	56.4	52.9	55.1	95	97	95	23	18	21	1.43	0.21	0.22	0.29	1.82	0.84	0.77	T.	0.00	0.00	58.4	59.2	56.1	57.9	98	
1894.....	58.4	59.2	56.1	57.9	98	94	97	22	17	14	2.07	1.32	0.25	1.21	4.33	2.80	1.90	0.59	0.30	0.00	53.2	63.0	50.7	52.3	93	
1895.....	53.2	63.0	50.7	52.3	93	86	87	16	12	11	0.30	0.68	0.72	0.70	0.53	2.15	1.88	0.00	0.41	T.	55.2	54.6	52.6	54.2	94	
1896.....	55.2	54.6	52.6	54.2	94	95	93	24	24	23	3.51	3.13	1.74	2.79	5.13	5.62	3.18	1.64	0.55	0.55	63.3	61.5	57.7	60.9	97	
1897.....	63.3	61.5	57.7	60.9	97	94	97	29	26	22	1.41	2.68	3.38	2.39	2.67	5.80	5.50	0.55	0.70	1.35	54.1	54.6	51.7	53.8	96	
1898.....	54.1	54.6	51.7	53.8	96	100	99	21	17	15	2.84	1.47	0.92	1.92	4.40	2.68	1.87	0.27	0.26	0.26	63.5	62.3	57.0	61.8	96	
1899.....	63.5	62.3	57.0	61.8	96	94	96	27	25	18	1.66	2.51	0.71	1.75	4.67	6.04	3.94	0.50	0.26	0.00	62.4	61.5	59.2	61.5	93	
1900.....	62.4	61.5	59.2	61.5	93	94	97	28	26	22	3.47	2.98	0.53	2.68	5.59	5.71	1.38	1.21	0.03	0.00	61.5	60.5	57.2	60.0	97	
1901.....	61.5	60.5	57.2	60.0	97	94	92	26	24	21	1.94	2.60	0.97	1.89	3.82	6.30	2.34	0.56	T.	59.7	58.8	57.1	58.8	98		
1902.....	59.7	58.8	57.1	58.8	98	94	90	26	22	20	2.22	2.26	2.13	2.21	3.72	4.00	2.93	0.82	1.23	1.55	67.4	65.0	57.2	58.2	99	
1903.....	67.4	57.6	55.2	57.2	99	92	93	21	17	14	4.74	4.16	1.98	3.63	8.02	7.98	2.87	0.25	0.16	0.16	67.1	64.9	41.0	41.9	93	
1904.....	67.1	64.9	41.0	41.9	93	82	83	20	18	17	0.85	0.11	0.04	0.33	2.24	0.65	0.44	T.	0.00	0.00	62.0	57.8	41.5	41.8	82	
1905.....	62.0	57.8	41.5	41.8	82	80	85	8	4	5	1.18	0.95	0.64	0.97	2.28	2.10	1.05	0.58	T.	0.20	40.6	42.0	40.6	40.6	85	
1906.....	40.6	37.8	34.2	37.7	78	78	82	-4	-1	-13	1.50	1.02	0.25	0.92	3.14	1.78	0.58	T.	T.	T.	43.6	42.0	40.6	42.2	85	
1907.....	43.6	42.0	40.6	42.2	85	88	90	0	-6	-10	1.41	1.01	0.67	1.10	2.72	1.75	1.55	0.30	T.	40.1	39.2	39.8	39.7	86		
1908.....	40.1	39.2	39.8	39.7	86	89	86	-10	-6	-10	1.41	1.01	0.67	1.10	2.72	1.75	1.55	0.30	T.	49.5	48.7	45.5	48.4	81		
1909.....	49.5	48.7	45.5	48.4	81	80	81	11	10	9	1.24	1.13	0.82	1.34	2.75	2.42	2.51	0.31	0.21	1.15	42.4	41.8	41.0	41.9	80	
1910.....	42.4	41.8	41.0	41.9	81																					

TABLE 2.—*Climatological data for Kansas.*

Year.	Temperature (in ° F.).								Precipitation (in inches).							
	Annual means.				Annual extremes.				Annual means.				Annual extremes.			
	Eastern division.	Middle division.	Western division.	State.	Maximum.	Month.	Minimum.	Month.	Eastern division	Middle division.	Western division.	State.	Greatest monthly mean.	Month.		
1887	55.5	56.3	58.8	54.4	110	July, August	-32	January	27.22	25.25	20.28	23.07	4.34	August.		
1888	53.4	54.1	51.7	53.5	103	do	-32	do	34.12	20.84	18.62	24.17	4.39	Do.		
1889	53.4	54.4	52.9	53.6	108	July	-17	February	37.01	32.52	19.51	29.47	5.48	May.		
1890	54.9	54.9	54.8	54.8	113	do	-23	January	31.79	23.58	14.88	20.65	4.06	August.		
1891	53.9	53.1	51.9	53.0	108	August	-10	February	34.00	32.79	29.21	30.90	6.28	June.		
1892	53.3	53.5	51.6	52.6	111	do	-34	January	39.68	27.78	17.98	29.06	6.90	May.		
1893	58.8	54.7	52.6	53.7	113	June, July	-15	February	30.23	18.58	11.98	20.12	3.91	June.		
1894	55.2	55.5	52.9	54.7	116	July	-26	July	28.76	21.25	12.19	20.72	4.94	Do.		
1895	54.0	54.3	51.7	53.2	112	do	-25	February	37.99	24.88	21.39	27.86	5.58	July.		
1896	56.3	56.3	54.6	55.8	114	June	-18	January	36.77	30.82	19.58	29.26	4.75	May, July.		
1897	55.6	55.5	53.8	55.1	113	do	-16	January, December	27.56	22.91	22.91	24.58	3.69	August.		
1898	54.4	54.3	53.0	54.2	110	July	-23	December	42.72	29.39	23.18	32.35	6.28	May.		
1899	54.3	54.6	53.4	54.3	110	June	-34	February	33.20	27.98	18.11	28.01	5.53	June.		
1900	56.0	56.6	55.3	56.0	110	do	-15	December	37.61	27.39	18.51	29.65	6.37	September.		
1901	55.6	55.6	54.1	55.4	112	July	-21	January	26.00	20.89	17.91	22.15	3.64	April.		
1902	54.3	54.3	53.9	54.2	112	August	-23	do	45.71	34.80	22.24	35.50	6.64	May.		
1903	53.9	53.6	52.2	53.4	110	July	-29	February	41.88	32.41	19.78	33.46	8.57	Do.		
1904	54.4	54.2	53.6	54.2	104	August	-19	January	41.72	30.11	21.22	32.86	8.80	June.		
1905	54.1	53.7	52.1	53.5	108	June	-40	February	39.85	29.53	22.94	32.09	7.92	September.		
1906	55.2	54.3	53.3	54.4	105	August	-15	March	34.00	28.65	23.16	29.48	5.56	June.		
Twenty years	54.6	54.7	53.2	54.2	116	July	-40	February	35.34	27.09	19.70	27.77	8.80	June.		

## PRECIPITATION.

The average annual precipitation ranges from 15.37 inches in the extreme western to 44.54 inches in the extreme southeastern part of the State. The average number of rainy days per year increases from 49 in the extreme western counties to 99 in the eastern. The average precipitation for winter ranges from 1 inch in the western counties to 4 inches in the eastern. The average for spring ranges from 4 inches in the western counties to 12 inches in the eastern; for summer it ranges from 8 inches in the west to 14 inches in the east, and for autumn from 2 inches in the west to 8 inches in the east. The total annual precipitation during the driest year ranged from 9.30 inches at Viroqua, Morton County, to 29.62 inches at Columbus, in Cherokee County, and for the wettest year it ranged from 21.16 inches at Wallace, Wallace County, to 57.97 at Lebo, Coffey County, and 58.30 at Columbus, Cherokee County.

## SNOWFALL.

The average annual snowfall ranges from 8.6 inches in Montgomery County to 25.6 inches in Atchison County, while in the western part of the State this order is reversed and we find it ranging from 18.1 inches in Thomas County to 21.2 inches in Morton. In the central part of the State McPherson County bears the palm with an annual average of 24 inches. The average annual number of days with measurable snowfall is least in the southern tier of counties, where it ranges from six to nine days, and greatest in the northeastern counties, where it is 15 and upward. The greatest snowfall in twenty-four hours is quite uniform over the State, ranging from 8 to 10 inches, but in the lower Solomon and Republican River valleys it increases to 11 and 12 inches. Around the headwaters of the Little Arkansas River, in McPherson County, it is 14 inches; in the valley of the Kaw it is 18 inches; in Morton, the extreme southwestern county, it is 20 inches.

## THUNDERSTORM DAYS.

The average annual number of days with thunderstorms ranges from less than 20 in the extreme southwestern counties to over 40 in the eastern. Wichita, in Sedgwick County, has the greatest number, its record showing 49 days. Otherwise the number of days with thunderstorms is quite uniform, except in the extreme western and extreme eastern counties, ranging between 34 and 37.

## HAILSTORM DAYS.

The average number of days with hailstorms is 2 in the extreme southeastern counties and 3 over the rest of the State, except in Trego, Ford, and Sedgwick counties, where the number is increased to 4.

## LIGHTNING AND POWERFUL ELECTRIC DISCHARGES.

In a memoir on "High Electromotive Force" by Prof. John Trowbridge, of Harvard University, published in Vol. XIII of the Memoirs of the American Academy of Arts and Sciences, the author gives a full description of his remarkable battery of 20,000 small cells, giving an electromotive force of 40,000 volts.

Such a battery gives discharges one or two yards long that simulate lightning itself and lead to the following remarks by the author elucidating this phenomenon.

\* \* \* Meteorological observations lead us to conclude that the lightning discharge is not produced like the discharge from a great number of storage cells arranged in series—that is, from one charged particle of water vapor to another—but rather from the accumulation in series of such charges at some point on the surface of the cloud, the cloud thus acting like a charged condenser. We can thus suppose that the outer layer of particles of water are more heavily charged than those in the interior of the cloud. \* \* \*

It seemed evident from observation of the phenomena that air at atmospheric pressure breaks down with great facility under high voltage combined with large amperage.

\* \* \* \* \* One is impressed in studying high voltage combined with large amperage that the study of electrical discharges by means of Holtz machines or other forms of glass inductors leads to limited conceptions of the amount of energy in lightning discharges. If Benjamin Franklin had worked with a high-tension storage battery, he probably never would have dared to try his celebrated kite experiment. Experience has shown that even five hundred volts combined with large current is sufficient to cause death.

\* \* \* \* \* The discharges from a large number of condensers, charged in multiple and discharged in series, are probably more nearly identical with lightning discharges than any other forms of discharges within our experimental means; and the photographs of such discharges reveal details which do not appear in the discharges from Ruhmkorff coils or Tesla coils.

With a large portrait lens many of such details appear which are not shown by small lenses. These details, however, are difficult to reproduce. Indeed it often happens in scientific investigation that one obtains faint images which can not be reproduced by any process of printing, and which do not give satisfactory results with ordinary pro-